



A Regional Approach to Developing Total Maximum Daily Loads for Mercury in the Coastal Bays and Gulf Waters of Louisiana

Water Quality Problem: King Mackerel Fish Consumption Advisory

The State of Louisiana requires that water quality in the Coastal Bays and Gulf Waters be “fishable and swimmable”. However, in September 1997, a fish consumption advisory for king mackerel (*Scomberomorus cavalla*) in the Gulf of Mexico off the coast of Louisiana was jointly issued by the Louisiana Department of Health and Hospitals (LDHH), the Louisiana Department of Environmental Quality (LDEQ), and the Louisiana Department of Wildlife and Fisheries (LDWF) due to elevated levels of mercury (Hg) in king mackerel. Louisiana's 2002 Consent Decree included Hg in king mackerel as a pollutant of concern in subsegments 010901, 021102, 031201, 042209, 050901, 061201, 070601, 110701, and 120806 which extends along the entire 397 miles of coastline and covers approximately 1,200 square miles of coastal waters.

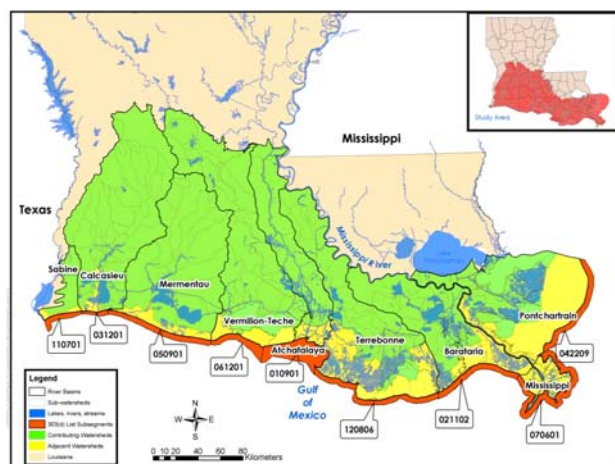


Exhibit 1 –TMDL Study Area

Mercury is highly toxic, persistent, and bioaccumulates in the food chain. Mercury is readily cycled in the earth's surface with the atmosphere playing an important role in its transport. Mercury deposited into streams, lakes, and coastal waters emanates from local, regional, and global sources, making it nearly impossible to pinpoint the exact source of contamination. For humans and wildlife, the Hg exposure pathway of particular concern is consumption of fish tissue with elevated levels of methylmercury, the principal form of mercury that is readily bioaccumulated by fish, humans, and other organisms.

In response to these conditions, a total maximum daily load (TMDL) project was initiated to determine the measures necessary to protect human health and remove the fish consumption advisories for six of the nine subsegments including 010901, 021102, 042209, 070601, 110701, and 120806. USEPA previously established Hg TMDLs for subsegments 031201, 050901, and 061201. USEPA Region 6 worked with a contractor, Parsons, and LDEQ to develop these TMDLs. Given the pervasive distribution of Hg and the large geographic area considered in this assessment, a regional rather than a waterbody-specific approach was used to determine the pollutant loading these waterbodies could assimilate without exceeding the water quality standards for Hg. These TMDLs estimate point source loadings of Hg to the contributing and adjacent watersheds, Hg loads from the Mississippi River Basin as nonpoint source contributions to the Gulf of Mexico, and nonpoint source Hg loads from atmospheric deposition.

Establishing a Goal for Reducing Mercury Levels in King Mackerel

In Louisiana, when the average Hg concentration exceeds 0.5 parts per million (ppm) in fish or shellfish, a fish consumption advisory may be issued. The concentration of Hg in king mackerel exceeds 1.0 ppm in numerous locations in Gulf Waters along the Louisiana coast. Fish tissue data show that under ambient conditions king mackerel demonstrate elevated concentrations of Hg independent of the sampling location in the Gulf of Mexico. The most reasonable endpoint for establishing a TMDL is the fish consumption advisory of 0.5 mg/kg. The benefits of using this fish tissue criterion are:

- (1) It accounts for spatial and temporal complexities that occur in aquatic systems;
- (2) It provides a numeric translator for the LDEQ narrative standard established to protect human health through fish consumption advisories;
- (3) It accounts for bioaccumulation and biomagnification in the aquatic food chain; and
- (4) It is more directly tied to the goal of protecting public health from consumption of edible fish.

To establish these TMDLs a connection was made between the Hg concentration in fish tissue and the point

source and nonpoint source loads of Hg to the environment. This connection was made to establish pollutant load reductions that lead to a decrease in the Hg concentration in king mackerel so the fish consumption advisory can be lifted and the “fishable” water quality designation restored. To do so, the USEPA assumes a linear relationship between atmospheric deposition and fish tissue concentrations. These TMDLs use the observed average king mackerel tissue concentration to calculate the percent decrease needed to achieve the target level of 0.5 mg/kg fish tissue methylmercury concentration. It is assumed that if the total mercury body burden of king mackerel were reduced to less than 0.5 mg/kg, each subsegment would achieve its “fishable” use designation.

Adaptive Management Approach to the TMDLs

An adaptive management TMDL approach was chosen for this project by USEPA and LDEQ because they recognized that information on the actual contributions of Hg from both point and nonpoint sources will be much better characterized in the future based on new information gathered and analyses performed.

During the implementation of these TMDLS, USEPA expects that point source loadings of Hg will be reduced primarily through Hg minimization programs developed and implemented by some point sources. During implementation of these TMDLS, the following activities are expected to occur:

- NPDES point source dischargers will develop and implement Hg minimization plans;
- Air emissions of Hg will be reduced through implementation of the Clean Air Act regulations;
- LDEQ will collect additional ambient data on Hg concentrations in water, sediment, fish, and soil using advanced analytical methods; and
- LDEQ will develop and implement an Hg risk reduction plan.

The waterbodies covered by these TMDLs are mainly impaired due to the deposition of Hg from the atmosphere. It is estimated that over 99 percent of the Hg load to the waterbodies comes from the atmosphere and about 1 percent of the loading is from point source discharges.

Point Source vs. Non-Point Source Load Estimates

The USEPA Permits Compliance System (PCS) database indicates that five point source dischargers out of 600 dischargers in the six subsegments have Hg limitations. All municipal WWTPs (SIC 4952) with a discharge greater than 100,000 gallons per day (gpd) are being assigned an

individual waste load allocation (WLA). In addition, a group allocation for dischargers with individual and general permits that may require a WLA in the future has also been included. The group allocation for all basins except the Sabine and Mississippi River Basins is based on the total flow for dischargers not given a specific WLA and a target concentration of 12 mg/L Hg. In summary, these wasteloads are based on Hg limits in existing permits, an assumption of 12 ng/L Hg in the discharge from WWTPs with flows greater than 100,000 gpd, and an unassigned wasteload.

The Mississippi River represents a significant source of Hg to the Coastal Bays and Gulf Waters of Louisiana, and is therefore classified as a nonpoint source. Insufficient data was available to conduct an in-depth simulation of the fate and transport of Hg in the water column or sediment resuspension; therefore USEPA chose to base its calculations of nonpoint source Hg loading for these TMDLs to the 303(d)-listed subsegments on the conservative assumption that 100 percent of the nonpoint source loads are transported to the coastal basins.

While various analyses for watershed Hg loadings are possible at various levels of complexity, the limited amount of data available for the Coastal Bays and Gulf Waters of Louisiana precluded use of detailed hydrodynamic modeling. As an alternative method, Hg contributions to the Coastal Bays and Gulf Waters of Louisiana from both adjacent watersheds and upstream contributing watersheds were calculated. USEPA used REMSAD, Version 7 to predict wet and dry Hg deposition in southern Louisiana. A report detailing the approach and outputs of REMSAD for the Louisiana coast entitled REMSAD Air Deposition Modeling in Support of TMDL Development for Southern Louisiana was finalized by USEPA Region 6 in August 2004. The model was enhanced to better account for the complex atmospheric chemistry of mercury species. The REMSAD model run for this project was set up using a 4-kilometer grid to provide better resolution in the southern part of Louisiana.

Output from the REMSAD model was used as input to the Pollutant Load (PLOAD) application of the BASINS Version 3 model to estimate nonpoint source Hg loads. PLOAD estimates nonpoint source loads on an annual average basis.

TMDL Results

LDEQ, in conjunction with LDWF, has sampled Hg in fish tissue since 1996. King mackerel were collected from six of the nine subsegments at stations throughout the Gulf of Mexico, and in all six subsegments the average Hg

concentration exceeded the endpoint of 0.5 mg/kg. The average concentration for Hg for all king mackerel collected off the coast of Louisiana is 1.2129 mg/kg. Expressed as a percent reduction, the TMDL calculations stipulate that mercury concentration in fish tissue must be reduced by 59 percent to achieve the safe tissue concentration of 0.5 mg/kg. The overall pollutant load reduction required is 1,455,796 grams per year (g/yr).

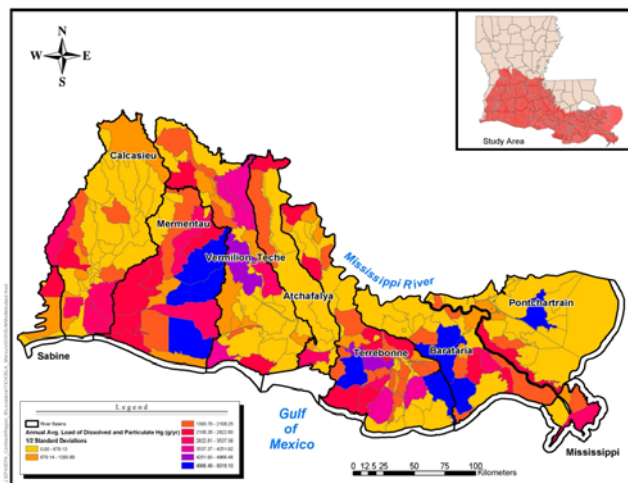


Exhibit 2 - Total Annual Average Loading of Dissolved and Particulate Mercury, g/yr

Pollutant Load Reductions

Since the majority of Hg in the environment is from air emission and most reductions will be achieved through Clean Air Act regulations, USEPA is not requiring point source dischargers to make any reductions at this time. The WLAs established for these TMDLs are set at the existing estimated wasteloads for each basin. The project

results indicate that current Hg loadings throughout the study area are primarily from nonpoint sources. Significant reductions in atmospheric deposition within and outside the study area will be necessary. USEPA expects ongoing and future activities under the Clean Air Act will achieve reductions in air deposition of Hg that will enable progress toward achievement of the Hg water quality standard.

To learn more about Louisiana water quality standards and monitoring efforts, read LDEQ's Mercury Contaminant Study, available on the web at:

www.deq.state.la.us/surveillance/mercury

For general information about how TMDL projects are structured, read the Louisiana TMDL Process Information, also available on the web at:

www.deq.state.la.us/technology/tmdl/index.htm

The U.S. EPA's Mercury Web Site also provides information on mercury and what's being done to protect human health:

www.epa.gov/mercury/index.html

For more information on these or other Louisiana TMDLs, contact the staff listed below:

USEPA, Region 6 Contact - Michael Morton, Dallas, Texas, (214) 665-8329

LDEQ Contact - Emelise Cormier, Baton Rouge, Louisiana, (225)-765-0759

Parsons Contact - Mel Vargas, Project Manager, Austin, Texas, (512) 719-6821

Coastal Segment	Segment Name	TMDL (g/yr)	WLA (g/yr)	LA (g/yr)	MOS (g/yr)
010901	Atchafalaya Bay and Delta	22,879	174	22,705	0
021102	Barataria Basin Coastal Bays	38,915	324	38,591	0
042209	Lake Pontchartrain Basin Coastal Bays	21,613	527	21,086	0
070601	Mississippi River Basin Coastal Bays	872,307	0	872,307	0
110701	Sabine River Basin Coastal Bays	8,255	57	8,198	0
120806	Terrebonne River Basin Coastal Bays	47,685	985	46,700	0

Exhibit 3 – TMDL Summary